

STRAP CLAMP

Field of the Invention

The present invention relates generally to clamps. More particularly, the
5 present invention relates to clamps for clamping pipes such as vehicle exhaust system
pipes.

Background

There are many applications where it is desirable to connect two pipes
together. One common application is vehicle exhaust systems. In vehicle exhaust
10 systems, two pipes are often connected at a "lap joint." A "lap joint" is formed by
inserting the end of one pipe into the end of another pipe such that the ends overlap one
another. A clamp is then placed around the overlapped ends of the pipes. The clamp
preferably functions to seal the lap joint and to mechanically connect the two pipes
together such that the two pipes are prevented from being pulled apart. Clamps are also
15 used on other types of vehicle exhaust components such as mufflers, catalytic
converters, particulate filters, nitric oxide traps, etc.

Numerous patents exist relating to clamps used for vehicle exhaust
systems. Some example patents related to this field include United States Patent No.
4,312,526 to Cassel, United States Patent No. 4,813,720 to Cassel, United States Patent
20 No. 6,116,659 to Wagner, United States Patent No. 4,790,574 to Wagner et al. and
United States Patent No. 5,116,083 to Gillingham et al. The clamps disclosed in the
above-identified patents are each made of a relatively thin, wide strap of ductile metal
and are often referred to as "wide-band clamps." Other example patents relating to this
field include United States Patent No. 6,305,054 to Imes et al., and United States Patent
25 No. 4,558,891 to Wagner et al., both of which are hereby incorporated by reference in
their entireties. The '054 patent and the '891 patent disclose clamps of the type often
referred to as "narrow-band clamps." Narrow-band clamps are typically more narrow
and substantially thicker than their wide-band counterparts.

Narrow-band clamps typically include a cylindrical strap having opposed ends separated by a gap. A fastener such as a bolt extends across the gap. To tighten the clamp about a pipe, a nut is threaded on the bolt causing the opposing ends of the strap to be drawn together thereby closing the gap. As the opposing ends of the strap are drawn together, it is sometimes possible for a portion of the pipe being clamped to pucker and become pinched into the gap. If the clamp is being used to seal a lap joint, this puckering and pinching action provides a possible area of leakage. A number of pipe clamps currently on the market from a number of different manufacturers have this problem.

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Summary

The present invention relates to a pipe clamp having structure for preventing a pipe from being pinched as the pipe is clamped.

A variety of advantages of the invention will be set forth in part in the description that follows, and in part will be apparent from the description, or may be learned by practicing the invention. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as claimed.

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Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate several aspects of the invention and together with the description, serve to explain the principles of the invention. A brief description of the drawings is as follows:

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Figure 1 is a perspective view of a clamp that is an embodiment of the present invention;

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Figure 1A is an enlarged detailed view of a portion of Figure 1;

Figure 2 is a top view of the clamp of Figure 1;

Figure 3 is a bottom view of the clamp of Figure 1;

Figure 4 is a front view of the clamp of Figure 1;

Figure 5 is a right side view of the clamp of Figure 1;

Figure 6 is a rear view of the clamp of Figure 1;

Figure 7 is a right side view of the clamp of Figure 1;

Figure 8 is a perspective view of a clamp that is another embodiment of
5 the present invention;

Figure 9 is a rear view of the clamp of Figure 8; and

Figure 10 is a right-side view of the clamp of Figure 8.

While the invention is amenable to various modifications and alternative
forms, the specifics thereof have been shown by way of example in the drawings and
10 will be described in detail below. It is to be understood, however, that the intention is
not to limit the invention to the particular embodiments described. On the contrary, the
intention is to cover all modifications, equivalents and alternatives falling within the
scope of the invention as defined by the appended claims.

Detailed Description

15 In the following detailed description, references are made to the
accompanying drawings that depict various embodiments in which the invention may
be practiced. It is to be understood that other embodiments may be utilized, and
structural and functional changes may be made without departing from the scope of the
present invention. Further, each of the features disclosed herein can be considered
20 standalone inventive features or features that have inventive aspects when considered in
combination with one another.

Figures 1-7 illustrate a clamp 20 that is an embodiment of the present
invention. The clamp 20 includes a strap 22 (i.e., a band or strip) adapted to surround a
pipe. The strap 22 includes first and second opposing ends 24 and 26 (best shown in
25 Figures 1 and 2) separated by a gap 28. A fastener 30 extends across the gap 28. The
fastener 30 functions to tighten or loosen the clamp 20 by narrowing or widening the
gap 28 between the first and second opposing ends 24 and 26. The first and second
opposing ends 24 and 26 are preferably configured to prevent a pipe from pinching or
puckering into the gap 28 during the clamping process. By preventing the pipe from

pinching into the gap 28, leaks are prevented and an improved seal is provided about the pipe (e.g., at a lap joint).

Referring to Figures 1, 1A and 2, the structure for preventing a pipe from being pinched in the gap 28 includes circumferential projections configured to intermesh when the clamp 20 is tightened. The first opposing end 24 includes two projections 32 and three recesses 32'. The opposing end 26 includes three projections 34 and two recesses 34'. When the clamp 20 is tightened, the projections 32 of the first opposing end 24 are received in the recesses 34' of the second opposing end 26, and the projections 34 of the second opposing end 26 are received in the recesses 32' of the first opposing end 24. When the projections 32 and 34 are received within their respective recesses 32' and 34', the projections 32 and 34 extend circumferentially past one another. It is noted that when the projections 32 and 34 are received into the recesses 32' and 34', the projections 32 and 34 do not ride over one another so as to form a double wall thickness. Instead, the projections 32 and 34 remain within a cylindrical boundary defined by the wall thickness of the strap 22.

It will be appreciated that the projections 32 have shapes that complement the recesses 34' into which they are received, and the projections 34 have shapes that complement the shapes of the recesses 32' into which they are received. As depicted in the drawings, at least some of the projections 32 and 34 have truncated triangular shapes. It will be appreciated that other shapes could also be used.

The strap 22 is preferably made of a material such as stainless steel or aluminized steel. In one non-limiting embodiment, the strap 22 has a width W (see Figs. 2 and 3) less than two inches, and a wall thickness T (see Figs. 4 and 6) in the range of .065 to .105 inches. Further, straps can be made at different diameters depending on the size of pipe desired to be clamped. In one embodiment, the strap has a diameter D (see Figs. 4 and 6) in the range of 1 3/4 - 7 inches.

Referring to Figures 4 and 6, the fastener 30 of the clamp 20 includes a bolt 40 having a base end 42 and a threaded end 44. The base end 42 is connected (e.g., welded or secured by another fastening technique) to the first opposing end 24 of the clamp 20. The threaded end 44 extends across the gap 28 and through a sleeve 46 (i.e.,

a tunnel) connected to (e.g., welded or fastened by other techniques) to the second opposing end 26. A nut 48 is threaded on the threaded end 44 of the bolt 40. By tightening the nut 48, contact against the sleeve 46 causes the opposing ends 24 and 26 to be drawn together such that the gap 29 closes. When the nut 48 is loosened, the gap 28 widens such that the clamp 20 is loosened. The fastener preferably has the same configuration as the fastener disclosed in U.S. Patent No. 6,305,054 that was previously incorporated by reference. It will be appreciated that other fastener configurations could also be used to tighten and loosen the clamp.

The strap 22 is preferably manufactured by punching the desired shape from a length of strap material. The strap 22 is then preferably rolled into a generally cylindrical configuration corresponding to that of a pipe through the use of a conventional roller forming process. With prior art clamps, it has at times proven difficult to form the opposing ends of such clamps with a curvature that precisely matches the curvature of the remainder of the strap. However, it has been determined by the inventors of the present invention that due to the reduction in material caused by providing recesses 32' and 34' at the opposing ends 24 and 26 of the strap 22, the ends (i.e., the projections 32 and 34) can be more easily formed to a curvature that matches the curvature of the remainder of the strap 22.

After the strap 22 has been formed into the cylindrical shape as described above, the bolt 40 can be connected to the first opposing end 24 of the strap 22. Thereafter, the sleeve 46 can be placed over the free end of the bolt 40 and connected to the second opposing end 26 of the strap 22. Finally, the nut 48 can be threaded on the threaded end 44 of the bolt 40.

Figures 8-10 show a clamp 20' that is another embodiment of the present invention. The clamp 20' includes a sleeve 22' having a reduced diameter portion 60 and an enlarged diameter portion 62. A radial step 64 provides a diameter change between the reduced diameter portion 60 and the enlarged diameter portion 62. A similar step is shown in U.S. patent No. 6,305,054 that was previously incorporated by reference. It will be appreciated that with the exception of the step 64, the clamp 20' has the same configuration as the clamp 20 of Figures 1-7.

The above specification, examples and data provide a complete description of the manufacture and use of the composition of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.